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SETS Based Science Teaching Materials with Guided Inquiry Learning Model to Improve Learning Outcomes in Optical Geometry Materials

Pandu Prasojo[1]; Tjipto Prastowo[2]; Muslimin Ibrahim[2]

[1] Postgraduate Student in science education, Surabaya State University, Jawa Timur, Indonesia

[2] Postgraduate lecturer in science education, Surabaya State University, Jawa Timur, Indonesia

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Abstract

This study aims to analyze the effectiveness of SETS based science teaching materials with guided inquiry learning model to improve the students' cognitive learning outcomes. This research was conducted by using learning cycles. The teaching materials developed were tested in class VIII MTs Bilingual Muslimat NU Pucang Sidoarjo semester even 2018/2019 academic year with the design of one group pretest-posttest design. Teaching materials developed include: (a) syllabus (b) Lesson Plan, (c) student books, (d) Worksheet, and (e) Learning Outcomes Assessment Sheet. The research parameters measured were the effectiveness of learning materials. The research data was obtained through validation, observation and test methods. The results of the study were analyzed descriptively quantitatively and qualitatively. Science literacy abilities of students are analyzed by n-gain. The results showed that (a) the learning devices developed were categorized as very valid, (b) the learning activities were carried out very well, (c) moderate scientific literacy skills. Based on the results of the analysis and discussion, it was concluded that the science learning device guided inquiry model that was developed valid, practical, and effective was used to increasing students' cognitive learning outcomes.

Keywords: *Development; Guided Inquiry Model; learning Outcomes*

Introduction

In the Minister of National Education Regulation number 22 of 2006 concerning content standards it is stated that language has a central role in the intellectual, social and emotional development of students and is a supporter of success in learning all fields of study. Language learning is expected to help students get to know themselves, their culture, and the culture of others, express ideas and feelings, participate in communities that express the language.

In the 2015 PISA (Program Internationale for Student Assessment) test conducted by the OECD (Organization for Economic Cooperation and Development) to test the ability of Science, Reading and Mathematics for 15-year-old students, Indonesia ranked 62 out of 70 countries taking the test the. The

results released can be explained by the ability of Indonesian students to get 403 points for the ability of Science with an average OECD of 493. For the ability to read Indonesia, it gets 397 points from the average OECD 493. Whereas for Mathematics abilities Indonesia gets 386 points from the average OECD 490. This shows that Indonesia is still far behind when compared to countries that took the PISA test. Even if this data is compared with the previous year there was an increase of 3 points for Science and 4 points for Mathematics. But actually the ability to read dropped by 2 points.

Measurement of scientific literacy is not only to master the extent of students' understanding of science knowledge, but also understanding of various aspects of the scientific process, as well as the ability to apply the scientific process in real situations (Wenning, 2007). The ability of scientific literacy is needed for students to be able to understand the circumstances such as the environment, health, economics, technology and various problems faced by modern society. This is in accordance with the nature of science education, namely increasing the competencies needed by students to be able to fulfill their lives (OECD, 2013).

Efforts that can be made to teach science in an integrated manner are the development of integrated science teaching materials with the SETS vision. Ministry of National Education (2006) states that through integrated science learning, students can gain direct experience, so that they can apply the concepts they have learned. Students are expected to gain broad views to solve problems in daily life through learning science (Mudakir, 2005). The application of the concept of science in everyday life can be applied through the SETS approach. The SETS approach is an integrated learning that is expected to be able to teach students to have the ability to see things in an integrated manner by paying attention to four elements namely science, environment, technology, and society (Binadja, 2002). Students are invited to study about SETS from various starting points depending on the basic knowledge possessed by students in the context of constructivism (Sardiyo and Pannen, 2005). Learning by applying concepts in daily life becomes meaningful when taught in a pleasant learning atmosphere.

Based on this reality, the problem can be formulated as follows: How is the feasibility of the SETS vision learning device to practice learning outcomes on the material of reflection and refraction of light? This study has the aim of producing a SETS visionary learning kit which is appropriate for improving student learning outcomes.

Learning devices are tools or tools used as benchmarks in teaching and learning activities in accordance with learning objectives. Teaching materials include Syllabus, Learning Implementation Plan, Student Worksheet, and instruments about science.

The syllabus is an outline of a program for implementing learning. Syllabus is a reference used for the preparation of learning frameworks on each subject matter material (Attachment to the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 22 Year 2016). The syllabus must contain education units, subjects, classes and semesters, subject matter, time allocation, core competencies, basic competencies, subject matter, learning indicators, learning activities, assessment, time allocation, and learning resources. The syllabus is based on Graduation Competency Standards and Content Standards for primary and secondary education units.

Learning Implementation Plan is a plan of learning activities carried out for one or more meetings. Developing a lesson plan must be based on a syllabus because as a reference students achieve basic competency . The teacher must compile lesson plans systematically and comprehensively so that learning takes place efficiently. Learning Implementation Plan is the development of a detailed learning plan from a specific subject matter or theme that refers to the syllabus. The lesson plan consists of education units, subjects, classes or semesters, subject matter, time allocation, core competencies, basic

competencies, indicators, learning objectives, learning materials, learning methods, learning media, learning resources, learning steps, and assessment. The material used in this research is mirror and lens.

Learning outcomes according to Sudjana (2002) are the abilities possessed by students after students receive their own learning experiences. One of the learning outcomes of students is influenced by their knowledge from the teacher, so the selection of learning models to be used needs to be considered well.

Research Methods

The subjects of this study were students in class. Students who were the subjects of the study were students of class VIII of Junior High School 2018/2019 Academic Year Learning activities carried out as many as 4 meetings using guided inquiry. The subject matter used in this study is the reflection and refraction of light.

This research was conducted in class VIII semester 2 MTs Bilingual Muslimat NU Pucang Sidoarjo aged between 12-15 years. Children over 11 years are classified as formal operational stages because they have the ability to think abstractly and have been able to solve problems through systematic experiments.

Planning

In this first step of planning, the researcher is assisted by a colleague to carry out the process of identifying the eighth grade students and to analyze learning problems, especially in science learning. Basic competencies Analyzing the properties of light, shading in the flat and curved areas and their application to explain the process of human vision, eyes insects, and the working principle of optical devices as well as basic competencies present the results of experiments on the formation of shadows on mirrors and lenses.

The activities carried out at this stage are as follows. Arrange learning cycle I, prepare observation instruments, compile learning evaluation tools, and
planning success criteria for improvement.

Implementation

Researchers carry out the learning process in accordance with the lesson plans agreed with colleagues who act as observers, each data in the process of this activity is recorded carefully and specifically documented as part of the observation activities.

Evaluation / observation

This stage is carried out by researchers by observing intensively the implementation of learning in class VIII. What the observer does is:

a. Observe the activities of students and teachers during the learning activities taking place.

b. Observing and recording all the symptoms that appear both support and that impede the implementation of learning.

c. Record or record these symptoms in the evaluation sheet.

d. Selecting data needed in research

Reflection

Reflection in this context is an evaluation of the learning activities that have been carried out. After the implementation and observation are completed, the next step is to review the successes and failures that occur in the learning process that has been implemented. Based on the evaluation or reflection, the researcher together with a colleague or partner teacher designs a research plan for Cycle II.

Student activity data were analyzed in quantitative description using the following percentage techniques:

$$P = \frac{\Sigma A}{\Sigma N} x100\%$$

Information:
P : Percentage of student activity
ΣA : The average total score of all aspects performed
ΣN: The maximum number of scores for all aspects observed

Complete learning indicators can be calculated as a percentage using the following formula:

$$\text{Completeness of LI} = \frac{\sum student\ of\ LI}{\sum student}\ X\ 100\%$$

Information:
LI: learning indicator

The learning indicator is said to be achieved if the percentage of mastery learning ≥ 70%.

Research Result

Classroom action research results obtained from the test results, both cycle I and cycle II.

Cycle I

In this study applied individually, the implementation of (lesson plan) RPP scenarios in the First Test of Class VIII MTs Bilingual Muslimat NU Pucang Sidoarjo in the learning process as a whole the average score of implementation is 3.60 with a very good category.
Following are the data on student achievement in cycle I obtained from the results of the posttest or the evaluation results I.

Table 1. Table of the results of the implementation of Try Out I

Criteria	First Meeting	Second Meeting	Third Meeting	Fourth Meeting
Opening	3.70	3.70	3.80	3.70
Main Activity	3.63	3.75	3.83	3.79
Last Activity	3.67	3.83	4.00	4.00
Class Condition	3.57	3.71	3.86	3.86

In the graph above it can be seen that from 33 students obtained data from meeting 1 to meeting 4 students showed an increase in the implementation of Learning Trial 1.

The implementation of cycle I also contained several advantages and disadvantages in the SETS Approach, namely:

1) Strengths

a) Some students have shown an active attitude, cooperation, and sincerity in the process science learning.
b) The teacher has done the preparation, implementation and evaluation in learning science fairly well.

2) Weaknesses

a) Students are not accustomed to following Inquiry learning.
b) Students are not familiar with aspects of science process skills and scientific literacy.
c) Students are not accustomed to doing experiments and the introduction of tools and materials is still weak so that when conducting experiments less in accordance with the experiments.

From the results of these reflections the second cycle is needed to improve student learning outcomes in science teaching materials Geometry Optics. In Cycle II learning improvements will be held and is expected to obtain maximum results.

Cycle II

In the second cycle of learning, the teacher still uses the SETS approach to learning science. The basic competencies to be achieved in cycle II activities are still the same as cycle I, but in cycle II students are more independent.

The following data on student achievement in cycle II obtained from the results of the posttest or evaluation results of learning cycle II.

Table 2. Table of the results of the implementation of Try Out II

Criteria	First Meeting	Second Meeting	Third Meeting	Fourth Meeting
Opening	3.70	3.60	3.70	3.70
Main Activity	3.71	3.93	3.86	3.79
Last Activity	3.83	3.67	3.83	3.67
Class Condition	3.86	3.86	3.71	3.86

In the table above it can be seen that from 33 students obtained data on the implementation of teaching materials using Inquiry learning models can improve literacy skills. Implementation of teaching materials by using the Inquiry learning model can improve cognitive products with a posttest score of 84.3 so that a cognitive increase of 0.76 products is obtained in the high category.

From the results of the reflections that have been done by researchers, there were no deficiencies in the learning process of natural science geometry optics using the SETS approach in cycle II, so researchers do not need to continue in cycle III.

Discussion

From the series of studies to data analysis it can be seen that:

This research was conducted in two stages, namely the stage of developing teaching materials that have been made and the implementation of teaching materials that were developed. The learning device developed first is validated and tested to produce a product that is appropriate in accordance with Plomp & Nieveen (2007). According to Plomp & Nieveen, to assess the quality of a product of research development there are three aspects that need attention, namely validity, practicality and effectiveness. Trial I was carried out as many as 10 students while for Trial II was carried out with a total of 30 student respondents.

The implementation of learning in Trials I and II in class VIII is generally categorized as good with a final average score of 3.75 and the percentage of appraisal matches from 2 observers is 94.30%. Based on the percentage above all phases of learning contained in the lesson plan scenario I tried in the good category (Ratumanan, 2011). The following is a graph of improving students' abilities in the Knowing aspect.

Table 3. Knowing domain outcome

Pretest	**55.71**
Posttest	82.86

Picture of 3 shows that student learning outcomes in the ability to know guided inquiry classes increased by 20.17%. Similarly, the ability to know, increased the ability to apply seen from the difference in the students' pretest and posttest scores. While in Trial II the results of the ability to apply can be seen in the graph above an increase of 29.53%. This shows the SETS learning process with the Inquiry model can improve student learning outcomes in the aspect of knowing.

In the Applying aspect can be seen the domain results in Trial I and Trial II based on the graph below:

Table 4. Applying domain outcome I

Pretest	**51.54**
Posttest	78.46

Table 5. Applying domain outcome II

Pretest	**55.13**
Posttest	82.82

Improving the ability to apply students based on Picture of 5 of 26.92%. The reasoning ability improvement is seen by finding the difference between the pretest and posttest scores for each class. Following are the results of student learning in Reasoning aspects. Improving students' reasoning abilities based on Picture of 6 and 7 by 20.9%.

Table 6. Reasoning domain outcome I

Pretest	**46.36**
Posttest	67.27

Table 7. Reasoning domain outcome II

Pretest	**58.18**
Posttest	69.70

In the students 'questionnaire responses, there are ten question items given to students to find out information on students' responses after the teacher uses the developed learning device. The teaching materials given received a very satisfying response that is 93%.

Table 8. Student responses

Answer	1 Item	2 Item	3 Item	4 Item	5 Item	6 Item	7 Item	8 Item	9 Item	10 Item
Positive	100%	100%	95%	100%	81%	83%	100%	65%	95%	100%
Negative	-	-	5%	-	19%	17%	-	35%	5%	-

The success of learning improvement in Trial II cannot be separated from the improvement and improvement of treatment from the previous learning cycle. Based on that, the development of a guided inquiry learning model with the SETS approach to improve student learning outcomes in Geometry Optics material can improve the ability to determine intrinsic story elements in class VIII MTs Bilingual Muslimat NU Pucang Sidoarjo students.

Conclusion

Based on the results of the discussion in the previous chapter it can be concluded that: the implementation of the lesson plan (RPP) scenario in the First Test of Class VIII MTs Bilingual Muslimat NU Pucang Sidoarjo in the learning process on average the overall score of the implementation is 3.60 with a very good category. Student activities in learning strongly support the application of the guided inquiry model, including conducting experiments, listening to teacher explanations, reading, asking questions, and discussing assignments.

Constraints found in implementing learning are: students are not accustomed to following learning with the guided inquiry learning model, students are not yet familiar with aspects of learning outcomes, and students are not yet accustomed to SETS aspects. The effectiveness of the teaching materials during implementation in the First Test in class VIII, seen from the aspects of the ability of learning outcomes, student activities and. The results obtained from the effectiveness of the teaching materials developed in Trial I.

Implementation of teaching materials by using the Inquiry learning model can improve literacy skills. The average pretest score for Trial I is 7.9 (level 1) while the posttest score is 67.1 (level 4). Increased literacy ability is 0.64 in the moderate category. Increased literacy ability is 0.64 in the moderate category.

Implementation of teaching materials by using Inquiry learning models can improve product cognitive. The average pretest score for the first tryout was 28.43 while the posttest score was 84.3. Increased cognitive product 0.76 in the high category.

Implementation of teaching materials by using Inquiry learning models can improve cognitive processes. The average pretest score for Trial I was 3.00 while the posttest score was 79.2.

Suggestion

Besides being able to develop student competencies, learning should pay attention to the following:

1. Implementation of learning scenarios is good but teachers need to be more careful in managing time during the learning process so that learning can run more effectively and efficiently.

2. Teaching materials using the guided inquiry learning model to train the ability of learning outcomes to be carried out at the level of Junior School and Elementary School using the same material.

3. The assessment carried out for further research should not only be on the cognitive domain but must include all three domains, namely psychomotor, and affective.

4. Inquiry teaching materials by practicing the ability of learning outcomes can be used as a reference in implementing the 2013 Curriculum.

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